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## THE GENUS *MATSUCOCCUS* WITH A NEW SPECIES. (HEMIP-HOMOP.)

By FRANK B. HERBERT, *Bureau of Entomology.*

### COCCIDAE, SUBFAMILY MARGARODINAE.

The Genus *Matsucoccus* Cockerell.

COCKERELL, T. D. A. In Can. Ent. XLI, 2, p. 56. (1909.)

*Type*—*Xylococcus matsumurae* Kuwana.

This genus was erected by Cockerell in 1908 to contain *Xylococcus matsumurae* Kuwana, from pine in Japan. He characterized it as follows:

"Female without marsupium; broad posteriorly, not elongated, antennae 10-jointed, close together; larva with antennae 7-jointed, and very peculiar crab-like legs, the femur large; male without whorls of long hairs on the antennal joints; caudal brush long, arising from apical segment; rudimentary hind wing with very large hooks. (Japan)."

With material of the type of the genus at hand together with two other species from pines in America, the genus may now be redescribed so as to include all of them, as follows:

Coccidae referable to the subfamily Margarodinae, i. e., adult female and first larva with legs and antennae, and at least one intermediate stage without these appendages.

Adult female elongate, broader posteriorly, with 9-segmented antennae, the latter transversely striated, except 1st and 2d segments. Legs well developed, also transversely striated. Tarsus attached at apex of tibia and strongly curved outward; with spines on inner margin of tibia, two hair-like digitules on tarsus and two knobbed digitules on tarsal claws. Without marsupium or anal tube. Mouthparts sometimes present.

Intermediate larval stage without legs, antennae or anal tube, the only conspicuous characters being mouthparts and spiracles. First stage larva with legs and 6-segmented antennae. All three stages possessing two thoracic and seven abdominal pairs of spiracles.

This genus is probably most closely related to *Kuwania*, *Steingelia* and *Stomacoccus*, all being without a marsupium or anal tube, but differs from them in several respects. The adult female, instead of bearing knobbed digitules on the tip of the tibia as in *Kuwania*, possesses a number of spines on the inner margin. The apodous larva of *Kuwania* also possesses only 4 pairs of abdominal spiracles, these on the first 4 abdominal segments. *Matsucoccus* differs from *Steingelia* and *Stomacoccus* in the number of antennal segments, the transversely striated legs and antennae and in having the anterior pair of legs normal in size. The tarsus and claw of the adult female bear only four digitules. The marsupium is lacking, in which respect this genus differs from *Callipappus* and *Xylococcus*. It also differs from the latter in that the anal tube is lacking. The mouthparts are sometimes present as is the case with several other genera referred to the Margarodinae.

It has been noticed that the antennae of those adult females which have not yet emerged from the skins of the apodous larvae, are retracted. That is, they are pulled back into the body, the distal half being within the basal half, the latter turned inside out.

In each of the species, the first exuvium is cast in a different manner, *matsumurae* rupturing on the ventor, *fasciculensis* on the cephalic end, and *acalyptus* on the dorsum.

#### Key to the Species.

- A. Adult female with a pair of heavy spines on 5th to 9th antennal segments; apodous larva oval, with all spiracles forming an acute angle with the surface; first stage larva with bases of antennae approximate, and exuvium rupturing cephalically; occurring within fascicles of pine needles in California ..... *fasciculensis* Herbert.

- AA. Adult female with a pair of heavy spines on 6th to 9th antennal segments only.
- B. Adult female with 8-shaped pores on tip of abdomen surrounded with a compound ring; apodous larva circular, with only last 4 pairs of spiracles forming an acute angle with the surface; first stage larva with bases of antennae approximate, and exuvium rupturing ventrally; occurring in galls in bark of pine twigs in Japan and Eastern United States ..... *matsumurae* (Kuwana).
- BB. Adult female with 8-shaped pores on tip of abdomen not surrounded with a compound ring; apodous larva oval, with all spiracles perpendicular to the surface; first stage larva with bases of antennae distant, exuvium rupturing dorsally; occurring exposed on needles of pine in Rocky Mt. Region..... *acalyptus* n. sp.

**Matsucoccus matsumurae** (Kuwana).

KUWANA, S. I. In *Insect World*, IX, 3 (March, 1905), Figs.

——— *Bull. Agr. Exp. Station, Japan*, I, 2, p. 209 (1907), Figs.

COCKERELL, T. D. A. In *Can. Ent.* XLI, 2, p. 56. (1909.)

First stage larvae, adult males and females were found on pine in Japan by Mr. Kuwana at the time he described this species. It was placed by him in the genus *Xylococcus*, to which it is rather closely related, but later removed from that genus by Dr. Cockerell.

Lately Mr. Kuwana has found the intermediate stages of both the male and female on *Pinus thunbergii*. Realizing that the original description needed some correcting and that the intermediate stages should be described, he very kindly turned his material over to the writer, being too busy with other matters to describe them himself.

In the mean time, Mr. Harold Morrison, Coccidologist for the Bureau of Entomology, had received material from the Eastern United States and recognized that the specimens belonged to *Matsucoccus*, whereupon they were forwarded to the writer. Upon comparison, the writer was surprised to find that they were identical with *matsumurae*.

The Eastern material was collected by Mr. J. G. Sanders on twigs of scrub pine (*Pinus virginiana*) on Good-hope Hill, District of Columbia, in 1905, by Dr. A. D. Hopkins on pitch pine (*P. rigida*) in Pennsylvania in 1906, and from the same host by Mr. J. T. Morton on the R. W. de Forest Estate, Centerport, Long Island, New York, in 1919.

The following descriptions are taken from the Japanese material, augmented by the material from the Eastern United States.

*Adult female*.—2.5 to 4.5 mm. long and 1 to 2 mm. broad, in outline elongate oval, somewhat narrowed anteriorly. In life dark brown. Derm rough or crinkled. Antennae transversely striated (except 1st and 2d segments),

9-segmented (not 10-segmented as stated by Kuwana), bases approximate; first segment large, slightly longer than broad, 2d nearly as broad but shorter, the remaining segments becoming successively more slender, each being widest near the outer end. Each segment bearing three or more slender setae, segments 6 to 9 each also bearing 2 heavier spines. Legs are moderately large, transversely striated, trochanter bearing 1 long seta, the femur, tibia and tarsus each a number of small setae, particularly on inner margin. Tarsus bearing two hair-like digitules and the tarsal claw two knobbed digitules. Eyes present, mouthparts sometimes present. Spiracles occurring along the margin of body. Dorsum of abdomen bearing transverse rows of large, simple, circular pores; both dorsum and venter bearing internal ducts, which viewed from above have the appearance of 8-shaped pores; others at tip of abdomen having the appearance of 8-shaped pores, each surrounded by a compound ring. (Plate III J.) Small setae present on both dorsum and venter. Anal ring not discernible.

*Second stage* or apodous larva.—Body nearly circular in outline, about 1.3 mm. long when full grown and in life of a brownish black color. (Plate III C.) Without eyes, legs or antennae. Spiracles large and conspicuous. (Plate III.) Surrounded by large numbers (more than ten) of small ducts and set at inner end of rather short tubes, the latter perpendicular to the derm, except last 3 on 4 abdominal pairs which are at an acute angle. Derm slightly chitinized or dorsum. Anal tube absent, anal ring not discernible. Male apodous larva very similar to that of female except smaller.

*First stage larva*.—Body oval, acute at both ends, in life reddish brown, about .3 mm. in length when full grown. (Plate III B.) Eyes prominent, situated on margin of body, posterior to 6-segmented antennae, the latter with approximate bases. Segment 1 large and broad, 2, 4 and 6 long, 3 and 5 short; segment 4 bearing 2 broad stiff spines and 6 bearing 2 broad stiff spines and a large nipple-like process on its tip. Legs rather small, femur broad, tibia, tarsus and claw slender, the latter bearing 2 knobbed digitules, tochanter bearing 1 long slender seta. Segmentation of abdomen distinct. Spiracles resembling a row of buttons on each side of abdomen. Tip of abdomen rounded, bearing a short and a long slender seta on each side of the apex. Derm somewhat chitinized. First exuvium rupturing on the venter.

*Male prepupa* very similar to adult female except somewhat smaller. Antennae and legs similar in all respects. All 8-shaped pores simple, not surrounded with a compound ring; without large circular pores. Eyes present.

*Male pupa* possessing prominent wing pads, legs and antennae, the latter apparently 9-segmented. Caudal end bearing a blunt central lobe.

*Male adult*, typical male of the Margarodinae, with compound eyes, dusky wings and caudal brush, well described by Mr. Kuwana. Legs and antennae long and slender, transversely striated, the latter 9-segmented. Instead of always being 10, the number of tubes from which the caudal brush arises, varies somewhat, usually more than that number.

This peculiar coccid as observed in American material, occurs on the twigs of pine, yet is hardly discernible due to the fact that it lives in a pit or gall under the surface of the bark (Plate III A). No twigs from Japan have been observed by the writer,

but Mr. Kuwana believes those live in similar positions. The only indication of its presence is a tiny black pin-hole in the bark and possibly a slight swelling at this point (Plate III A). In the mouth of the pin-hole can be found the cast skin of the first stage larva; under this and in a distinct cell under the surface of the bark can be found the second stage apodous larva or possibly only its cast skin. In emerging the adult female ruptures the skin of the second larva on its back and squeezes out through the tiny pin-hole, knocking away the skin of the first larva. From several hardened nearly dead twigs received from New York, the adult females were unable to emerge and were found still within the skins of the apodous larvae, in which they had secreted a mass of fluffy wax. According to Mr. Kuwana, they surround their eggs with this material when laid.

The only live forms found in the twigs collected in New York in October, 1919, were the apodous larvae, some of them containing immature female adults. These were found in the most recent season's growth. In Japan, Mr. Kuwana found apodous larvae, male prepupae and pupae in April, male and female adults early in May, and eggs and young larvae later in the same month.

There is probably but one generation per year, the larvae hatching in the spring and settling on the growing twigs, where they soon molt to apodous larvae. It is quite astonishing that they are able to form galls in the twigs. It is apparently done simply by the bark growing around and over the insect until it is finally covered in much the same way that a scar is covered up. For this reason it is necessary that they settle on the very young growing shoots.

The insect is doing considerable damage to the pines on the de Forest Estate on Long Island. Many of the small twigs are being killed. Probably spraying with a miscible oil in the spring as soon as the eggs hatch, would prove to be an effective remedy.

Having been described from Tokyo, Japan, in 1903 and collected in Pennsylvania and the District of Columbia in 1905 and 1906, it is a question as to which is its native haunt. There has been a considerable shipment of pines from Japan to America, which would indicate that it probably came from Japan. Also the fact that the insect is doing damage at Long Island would make it appear to be an introduced species, for native species are seldom noticeably harmful. However, its closest relatives, the other two species of this genus, are apparently native to the Western United States, which would be a strong indication that this species also is native to America. There is a slight possibility that this is native to both countries, being a relic of the preglacial period, when the countries were connected. Although scale insects seem to change slowly, one would expect some difference to have taken place during that time.

**M. fasciculensis** Herbert.<sup>1</sup>

HERBERT, F. B. In Proc. Ent. Soc. Wash., XXI, 7, p. 157. (Oct., 1919.)

This species was recently described from California, occurring within the fascicles of three-leaved pines. The antennae of the adult female bear pairs of heavy spines on segments 5 to 9. The apodous larva is oval in outline with all of the spiracles borne at an acute angle to its derm. This species seems to differ from the other two in that it has two larval stages instead of one preceding the apodous form, both of which are similar except for size. In the first larval stage the bases of the antennae are approximate. The antennae were considered to be 7-segmented in the original description, but comparison with the other species indicates that the last segment is in reality a nipple-like process occurring on the 6th. However, it is merely a matter of opinion as a slight lightening of the integument at the base of the former might be interpreted by some as indicating a 7th segment.

**M. acalyptus**, new species.

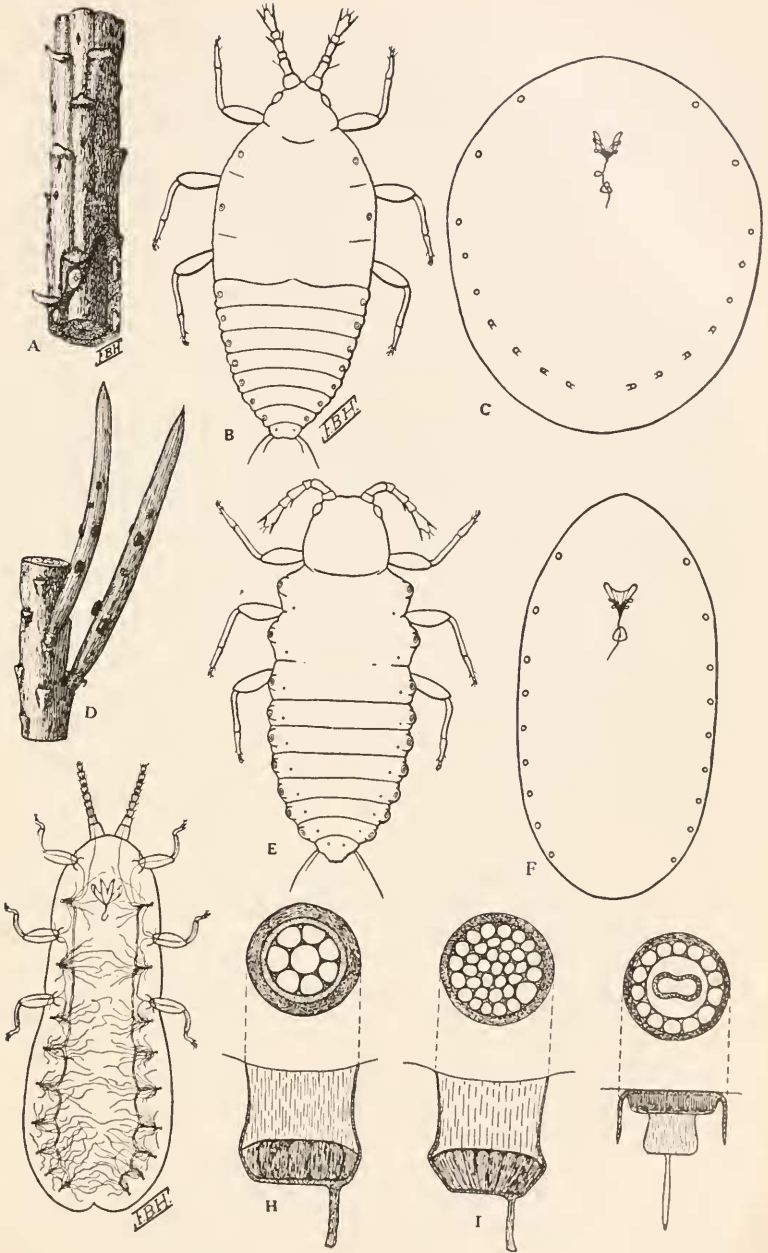
*Adult female*.—2 to 3 mm. long and .8 to 1.3 mm. broad, elongate oval in outline, somewhat narrowed anteriorly. (Plate III G.) Derm rough or crinkled. Antennae rather faintly transversely striated (except 1st and 2d segments), 9-segmented, bases approximate. 1st segment large, slightly longer than broad, 2d nearly as long and broad, remaining segments becoming successively more slender, each being widest near outer end. Each segment bearing 3 or more slender setae, segments 6 to 9 each also bearing 2 heavier spines. Legs moderately large, transversely striated, trochanter bearing 1 long slender seta, the femur, tibia and tarsus each bearing a number of small setae, particularly on inner margin. Tarsus bearing 2 hair-like digitules and the tarsal claw 2 knobbed digitules. Eyes present, mouthparts usually present. Tracheal system consisting of one main trachea paralleling the margin of abdomen, each spiracle being connected to it by a single smaller trachea; a number of auxiliaries also extending from the latter toward the center and appendages of body. (Pl. III G.) Dorsum of abdomen bearing transverse rows of large, simple, circular pores, both dorsum and venter bearing internal ducts, which viewed from above have appearance of 8-shaped pores. Small setae present on both dorsum and venter. Anal ring not discernible.

*Second stage* or apodous larva.—Body elongate oval in outline, about 1.5 mm. long and  $\frac{1}{2}$  as wide when full grown; in life of a brownish black color. (Pl. III F.) Without eyes, legs or antennae. Spiracles large and conspicuous, each surrounded by a number (3 to 10) of small ducts and set at inner end of a rather short tube, its outer end appearing as a dark chitinized circle. (Pl. III H.) All perpendicular to derm, the latter somewhat chitinized. Anal tube absent, anal ring not discernible.

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<sup>1</sup>This species has been made the type of the new genus *Americoccus* by MacGillivray, "The Coccidae," Jan., 1921, based on the described differences in the antennae.—Editor.





HERBERT—THE GENUS MATSUCOCCUS.

*First stage larva*.—Body elongate, .5 mm. in length when full grown, with sides nearly parallel and caudal end abruptly acute. (Pl. III E.) In life of a brownish color and surrounded with rays of wax. Head separated from and distinctly narrower than rest of body, and with prominent eyes. Antennae 6-segmented, bases well separated: segment 1 rather large and broad, 2 long without spines or setae, 3 very short, 4 long, bearing 1 broad stiff spine, 5 medium, 6 very long bearing 2 broad stiff spines and a small nipple-like process on its tip. Legs rather small, femur broad, tibia, tarsus and claw slender, the latter bearing 2 knobbed digitules. Trochanter bearing 1 long slender seta. Segmentation of abdomen distinct. Spiracles each on a raised process, together resembling a row of buttons on each side of abdomen; also a very small transparent pore dorsad of each spiracle. Tip of abdomen rounded, bearing a short and a long slender seta on each side of apex. Dorsum somewhat chitinized. First exuvium rupturing on dorsum.

*Male*.—Unknown.

*Types*.—Holotype, an adult female, and paratypes of adults and larvae from exposed portions of the needles of the single-leaf pinon (*Pinus monophylla*) from southern Idaho. Holotype and paratypes in the Entomological Collection at Stanford University. Paratypes also in the National Collection of Coccidae and the Forest Insect Collection at Los Gatos, California.

This material was received by Prof. R. W. Doane from Mr. P. J. O'Gara several years ago, simply with the information that it was apparently doing some damage in Idaho and requesting a determination. It was recently inspected by Mr. G. F. Ferris, who, upon finding it to be a *Matsucoccus*, kindly turned it over to the author to be described with the request that the type be deposited in the Entomological Collection at Stanford University. This has been done. To the above mentioned gentlemen the fullest thanks are due for the privilege of describing this species.

#### EXPLANATION OF PLATE III.

- A. Section of *Pinus rigida* twig showing pits or galls containing immature forms of *M. mastumurae*.
- B. First stage larva of *M. matsumurae*.
- C. Apodous larva of same.
- D. Immature forms of *M. acalyptus*, n. sp., on needles of *Pinus monophylla*.
- E. First stage larva of same.
- F. Apodous larva of same.
- G. Adult female of same showing tracheal system.
- H. Top view and cross-section of spiracle of apodous larva of *M. acalyptus*.
- I. Same of *M. mastumurae*.
- J. Cross-section of internal duct of *M. matsumurae* and top view of same, showing 8-shaped pore surrounded with compound ring.

All greatly enlarged, the early stages more than the later stages. Drawn by F. B. Herbert. For illustrations of adult legs, antennae, etc., see Plates XIII and XIV, Proc. Ent. Soc. Wash., Vol. 21, No. 7 (Oct., 1919).